

































































































































































































































































































































































































2650 causes the expansion cone 2635 to be axially displaced and thereby radially expand the expandable tubular member 2630. The chamber 2650 is preferably adapted to move upwardly within the expandable tubular member 2630 as the expansion cone 2635 and end plate 2645 are axially displaced within the  
5 expandable tubular member 2630.

The slips 2655 are coupled to the end plate 2645. The slips 2655 are preferably adapted to permit the end plate 2645 to be displaced in the upward axial direction; but prevent axial displacement of the end plate 2645 in the downward direction. In this manner, the chamber 2650 is pressurized by injecting fluidic  
10 materials into the chamber 2650. Because the end plate 2645 is maintained in a substantially stationary position, relative to the expandable tubular member 2630, during the injection of pressurized fluidic materials into the chamber 2650, the pressurization of the chamber 2650 preferably axially displaces the expansion cone 2635. In a preferred embodiment, when the slip joint 2640 is fully extended, the slip  
15 joint 2640 then displaces the end plate 2645 in the upward axial direction. In a preferred embodiment, when the spring force of the elastic member 2640c of the slip joint 2640 is greater than the fluidic pressurization force within the chamber 2650, the end plate 2645 is displaced in the upward axial direction.

The sealing members 2670 are coupled to the end plate 2645. The sealing  
20 members 2670 are further preferably sealingly coupled to the interior walls of the expandable tubular member 2630. In this manner, the chamber 2650 is optimally pressurized during operation of the apparatus 2620.

The upper sealing member 2675 is preferably coupled to the outside surface of the upper section 2695 of the expandable tubular member 2630. The upper  
25 sealing member 2675 is preferably adapted to fluidically seal the interface between the radially expanded upper section 2695 of the expandable tubular member 2630 and the wellbore casing 2600. The upper sealing member 2675 may be any number of conventional commercially available sealing members. In a preferred embodiment, the upper sealing member 2675 is viton rubber in order to optimally  
30 provide load carrying and pressure sealing capacity.

The lower sealing member 2680 is preferably coupled to the outside surface of the upper section 2695 of the expandable tubular member 2630. The lower  
sealing member 2680 is preferably adapted to fluidically seal the interface between the radially expanded upper section 2695 of the expandable tubular member 2630  
35 and the open hole wellbore section 2605. The lower sealing member 2680 may be

any number of conventional commercially available sealing members. In a preferred embodiment, the lower sealing member 2680 is viton rubber in order to optimally provide load carrying and pressure sealing capacity.

5 As illustrated in FIG. 26a, the apparatus 2620 is preferably positioned within the wellbore casing 2600 and the open hole wellbore section 2605 with the expandable tubular member 2630 positioned in overlapping relation to the wellbore casing 2600. In a preferred embodiment, the lower section 2685 of the expandable tubular member 2630 is then anchored to the open hole wellbore section 2605 using one or more of the apparatus and methods described above with reference to FIGS.  
10 1a to 25c.

As illustrated in FIG. 26b, the radial expansion of the expandable tubular member 2630 is then initiated by: (1) applying an upward axial force to the expansion cone 2635; and/or (2) pressurizing the chamber 2650 by injecting a pressurized fluidic material into the chamber 2650.

15 In a preferred embodiment, the expandable tubular member 2630 is radially expanded by applying an upward axial force to the expansion cone 2635. In a preferred embodiment, once the slip joint 2640 is fully extended, the end plate 2645 is then axially displaced in the upward direction. In this manner, the end plate 2645 follows the expansion cone 2635. In a preferred embodiment, the chamber 2650 is pressurized when the frictional forces exceed a predetermined value. In this  
20 manner, the axial displacement of the expansion cone 2635 is provided by applying an axial force that is selectively supplemented by pressurizing the chamber 2650.

In an alternative embodiment, a compressible cement and/or epoxy is injected into the annular space between the unexpanded portion of the tubular member 2630 and the wellbore casing 2600 before and/or during the extrusion process. The compressible cement and/or epoxy is then preferably permitted to at least partially cure prior to the initiation of the radial expansion process. In this  
25 manner, an annular structural support and fluidic seal is provided around the tubular member 2630.

30 As illustrated in FIG. 26c, in a preferred embodiment, after the expandable tubular member 2630 has been completely extruded off of the expansion cone 2635, a new section of wellbore casing is formed that preferably includes the radially expanded tubular member 2630 and an outer annular layer of a fluidic sealing material. More generally, the apparatus 2620 is used to repair or form wellbore  
35 casings, pipelines, and structural supports.

Referring initially to FIG. 27, a preferred method 2700 of coupling an expandable tubular member to a preexisting structure includes the steps of: (1) coupling the expandable tubular member to the preexisting structure by axially displacing an expansion cone; and (2) radially expanding the expandable tubular by applying direct radial pressure.

In a preferred embodiment, as illustrated in FIG. 28, in step 2705, an expandable tubular member 2805 is coupled to a preexisting wellbore casing 2810 positioned within a subterranean formation 2815. In a preferred embodiment, the wellbore casing 2810 further includes an outer annular layer 2820 of a fluidic sealing material such as, for example, cement. The expandable tubular member 2805 may be coupled to the preexisting wellbore casing 2810 using any number of conventional commercially available methods for coupling an expandable tubular member to a preexisting structure such as, for example, pulling an expansion cone through a tubular member, or pushing an expansion cone through a tubular member using a pressurized fluidic material. In a preferred embodiment, the expandable tubular member 2805 is coupled to the preexisting structure 2810 using one or more of the apparatus and methods disclosed in the following: (1) U.S. utility patent application serial no. 09/454,139, attorney docket no. 25791.3.02, filed on 12/3/1999, which claimed the benefit of the filing date of U.S. provisional patent application no. 60/111,293, attorney docket no. 25791.3, filed on 12/7/1998; (2) U.S. utility patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, which claimed the benefit of the filing date of U.S. provisional application no. 60/121,702, filed on 2/25/1999; (3) U.S. utility patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claimed the benefit of the filing date of U.S. provisional application no. 60/119,611, attorney docket no. 25791.8; (4) U.S. utility patent application serial no. 09/440,338, attorney docket no. 25791.9.02, filed on 11/15/1999, which claimed the benefit of the filing date of U.S. provisional application no. 60/108,558, attorney docket no. 25791.9, filed on 11/16/1998; (5) U.S. provisional patent application no. 60/183,546, filed on 2/18/2000; (6) U.S. utility patent application no. 09/523,460, attorney docket no. 25791.11.02, filed on 3/10/2000, which claimed the benefit of the filing date of U.S. provisional application no. 60/124,042, filed on 3/11/1999; (7) U.S. utility patent application no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claimed the benefit of the filing dates of U.S. provisional application no. 60/121,841, attorney docket no. 25791.12, filed on 2/26/1999 and U.S. provisional

application no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999; (8) U.S. utility application no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, which claimed the benefit of the filing date of U.S. provisional serial no. 60/121,907, attorney docket no. 25791.16, filed on 2/26/1999; (9) U.S. utility patent application no. 09/588,946, attorney docket no. 25791.17.02, filed on June 7, 2000, which claimed the benefit of the filing date of U.S. provisional patent application serial no. 60/137,998, attorney docket no. 25791.17, filed on 6/7/1999; (10) U.S. utility patent application no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claimed the benefit of the filing date of U.S. provisional application  
10 no. 60/131,106, attorney docket no. 25791.23, filed on 4/26/1999; (11) U.S. provisional application no. 60/146,203, attorney docket no. 25791.25, filed on 7/29/1999; (12) U.S. provisional application no. 60/143,039, attorney docket no. 25791.26, filed on 7/9/1999; (13) U.S. provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999; (14) U.S. provisional  
15 application no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999; (15) U.S. provisional patent application no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999; and (16) U.S. provisional patent application no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, the disclosures of which are incorporated herein by reference. In a preferred embodiment, the amount of radial  
20 expansion provided in step 105 ranges from about 5% to 20%.

In a preferred embodiment, as illustrated in FIG. 29, in step 2710, at least a portion of the expandable tubular member 2805 is further radially expanded by using a radial expansion tool 2905 to apply direct radial pressure to the expandable tubular member 2805. The radial expansion tool 2905 may be any number of  
25 conventional radial expansion tools suitable for applying direct radial pressure to a tubular member. In a preferred embodiment, the radial expansion tool 2905 is provided substantially as disclosed on one or more of the following U.S. Patents: 5,014,779 and 5,083,608, the disclosures of which are incorporated herein by reference. In a preferred embodiment, the amount of radial expansion of the  
30 expandable tubular member 2805 provided in step 2710 ranges up to about 5%. In a preferred embodiment, the radial contact pressures generated by the radial expansion tool 2905 in step 2710 range from about 5,000 to 140,000 psi. in order to optimally plastically deform the expandable tubular member 205 to the final desired geometry.

In a preferred embodiment, the radial expansion provided in step 2705 is limited to the portion of the expandable tubular member 2805 that overlaps with the preexisting wellbore casing 2810. In this manner, the high compressive forces typically required to radially expand the portion of the expandable tubular member 2805 that overlaps with the preexisting wellbore casing 2810 are optimally provided.

In an alternative embodiment, the radial expansion in step 2705 radially expands the expandable tubular member 2805 to provide an inside diameter substantially equal to the inside diameter of the pre-existing wellbore casing 2810. In this manner, a mono-diameter wellbore casing is optimally provided.

Thus, the method 2700 provides a 2-step radial expansion process that utilizes: (1) a relatively quick method of radial expansion for the majority of the radial expansion; and (2) a high contact pressure method for the remaining radial expansion. In several alternative embodiments, the method 2700 is used to form or repair wellbore casings, pipelines, or structural supports.

The method 2700 further provides an apparatus and method for coupling an expandable tubular member to a preexisting structure. The expandable tubular is initially coupled to the preexisting structure by axially displacing an expansion cone within the expandable tubular member. The expandable tubular member is then further radially expanded by applying a radial force to the expandable tubular. The apparatus and method have wide application to the formation and repair of wellbore casings, pipelines, and structural supports. The apparatus and method provide an efficient and reliable method for forming and repairing wellbore casings, pipelines, and structural supports. In a preferred implementation, the initial radial expansion of the expandable tubular member by axially displacing the expansion cone provide from about 5% to 25% of radial expansion, and the subsequent application of direct radial pressure to the expandable tubular member provides an additional radial expansion of up to about 10%. In this manner, the desired final geometry of the radially expanded tubular member is optimally achieved in a time efficient and reliable manner. This method and apparatus is particularly useful in optimally creating profiles and seal geometries for liner tops and for connections between jointed tubulars.

A method of coupling an expandable tubular member to a preexisting structure has been described that includes positioning the tubular member and an expansion cone within the preexisting structure, anchoring the tubular member to the preexisting structure, axially displacing the expansion cone relative to the tubular

member by pulling the expansion cone through the tubular member, and lubricating the interface between the expansion cone and the tubular member. In a preferred embodiment, lubricating the interface between the expansion cone and the tubular member includes: injecting a lubricating fluid into the trailing edge of the interface

5 between the expansion cone and the tubular member. In a preferred embodiment, the lubricating fluid has a viscosity ranging from about 1 to 10,000 centipoise. In a preferred embodiment, the injecting includes: injecting lubricating fluid into a tapered end of the expansion cone. In a preferred embodiment, the injecting includes: injecting lubricating fluid into the area around the axial midpoint of a first tapered end

10 of the expansion cone. In a preferred embodiment, the injecting includes: injecting lubricating fluid into a second end of the expansion cone. In a preferred embodiment, the injecting includes: injecting lubricating fluid into a tapered first end and a second end of the expansion cone. In a preferred embodiment, the injecting includes: injecting lubricating fluid into an interior of the expansion cone. In a

15 preferred embodiment, the injecting includes: injecting lubricating fluid through an outer surface of the expansion cone. In a preferred embodiment, the injecting includes: injecting the lubricating fluid into a plurality of discrete locations along the trailing edge portion. In a preferred embodiment, the lubricating fluid includes drilling mud. In a preferred embodiment, the lubricating fluid further includes:

20 TorqTrim III, EP Mudlib, and DrillN-Slid. In a preferred embodiment, the lubricating fluid includes TorqTrim III, EP Mudlib, and DrillN-Slid. In a preferred embodiment, the interface between the expansion cone and the tubular member includes: coating the interior surface of the tubular member with a lubricant. In a preferred embodiment, lubricating the interface between the expansion cone and the tubular

25 member includes: coating the interior surface of the tubular member with a first part of a lubricant, and applying a second part of the lubricant to the interior surface of the tubular member. In a preferred embodiment, the lubricant comprises a metallic soap. In a preferred embodiment, the lubricant is selected from the group consisting of C-Lube-10, C-PHOS-58-M, and C-PHOS-58-R. In a preferred embodiment, the

30 lubricant provides a sliding friction coefficient of less than about 0.20. In a preferred embodiment, the lubricant is chemically bonded to the interior surfaces of the tubular members. In a preferred embodiment, the lubricant is mechanically bonded to the interior surfaces of the tubular members. In a preferred embodiment, the lubricant is adhesively bonded to the interior surface of the tubular members. In a preferred

embodiment, the lubricant includes epoxy, molybdenum disulfide, graphite, aluminum, copper, aluminosilicate and polyethylenepolyamine.

5 A method of coupling a tubular member to a preexisting structure has also been described that includes positioning the tubular member and an expansion cone within the preexisting structure, anchoring the tubular member to the preexisting structure, and axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member. The tubular member preferably includes: an annular member, including: a wall thickness that varies less than about 8 %, a hoop yield strength that varies less than about 10 %, 10 imperfections of less than about 8 % of the wall thickness, no failure for radial expansions of up to about 30 %, and no necking of the walls of the annular member for radial expansions of up to about 25%.

15 A method of coupling a tubular member to a preexisting structure has also been described that includes injecting a lubricating fluid into the preexisting structure, positioning the tubular member and an expansion cone within the preexisting structure, anchoring the tubular member to the preexisting structure, and axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member. In a preferred embodiment, the lubricating fluid includes: BARO-LUB GOLD-SEAL™ brand drilling mud lubricant.

20 A method of coupling an expandable tubular member to a preexisting structure has also been described that includes positioning the expandable tubular member and an expansion cone within the preexisting structure, anchoring the expandable tubular member to the preexisting structure, and axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member. In a preferred 25 embodiment, the expandable tubular member includes: a first tubular member, a second tubular member, and a threaded connection for coupling the first tubular member to the second tubular member. In a preferred embodiment, the threaded connection includes: one or more sealing members for sealing the interface between the first and second tubular members. In a preferred embodiment, the threaded 30 connection comprises a pin and box threaded connection. In a preferred embodiment, the sealing members are positioned adjacent to an end portion of the threaded connection. In a preferred embodiment, one of the sealing members is positioned adjacent to an end portion of the threaded connection; and wherein 35 another one of the sealing members is not positioned adjacent to an end portion of

F 150000

the threaded connection. In a preferred embodiment, a plurality of the sealing members are positioned adjacent to an end portion of the threaded connection.

5 A method of coupling an expandable tubular member to a preexisting structure has also been described that includes positioning the expandable tubular member and an expansion cone within the preexisting structure, anchoring the expandable tubular member to the preexisting structure, and axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member. In a preferred embodiment, the expandable tubular member includes a plurality of tubular members having threaded portions that are coupled to one another by the process of: coating the threaded portions of the tubular members with a sealant, coupling the threaded portions of the tubular members, and curing the sealant. In a preferred embodiment, the sealant is selected from the group consisting of epoxies, thermosetting sealing compounds, curable sealing compounds, and sealing compounds having polymerizable materials. In a preferred embodiment, the method further includes: initially curing the sealant prior to radially expanding the tubular members, and finally curing the sealant after radially expanding the tubular members. In a preferred embodiment, the sealant can be stretched up to about 30 to 40 percent after curing without failure. In a preferred embodiment, the sealant is resistant to conventional wellbore fluidic materials. In a preferred embodiment, the material properties of the sealant are substantially stable for temperatures ranging from about 0 to 450 °F. In a preferred embodiment, the method further includes: applying a primer to the threaded portions of the tubular members prior to coating the threaded portions of the tubular members with the sealant. In a preferred embodiment, the primer includes a curing catalyst. In a preferred embodiment, the primer is applied to the threaded portion of one of the tubular members and the sealant is applied to the threaded portion of the other one of the tubular members. In a preferred embodiment, the primer includes a curing catalyst.

30 A method of coupling a tubular member to a preexisting structure has also been described that includes positioning the tubular member and an expansion cone within the preexisting structure, anchoring the tubular member to the preexisting structure, and axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the expandable tubular member. In a preferred embodiment, the tubular member includes: a pair of rings for engaging the

preexisting structure, and a sealing element positioned between the rings for sealing the interface between the tubular member and the preexisting structure.

5 A method of coupling a tubular member to a preexisting structure has also been described that includes positioning the expandable tubular member and an expansion cone within the preexisting structure, anchoring the expandable tubular member to the preexisting structure, and axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member. In a preferred embodiment, the tubular member includes one or more slots. In a preferred embodiment, the slots are provided at a preexpanded portion of the tubular member. In a preferred embodiment, the slots are provided at a non-preexpanded portion of the tubular member.

15 A method of coupling a tubular member to a preexisting structure has also been described that includes positioning the expandable tubular member and an expansion cone within the preexisting structure, anchoring the expandable tubular member to the preexisting structure, and axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member. In a preferred embodiment, the tubular member includes: a first preexpanded portion, an intermediate portion coupled to the first preexpanded portion including a sealing element, and a second preexpanded portion coupled to the intermediate portion.

20 A method of coupling a tubular member to a preexisting structure has also been described that includes positioning the expandable tubular member and an expansion cone within the preexisting structure, anchoring the expandable tubular member to the preexisting structure, and axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member by applying an axial force to the expansion cone. The axial force preferably includes a substantially constant axial force, and an increased axial force. In a preferred embodiment, the increased axial force is provided on a periodic basis. In a preferred embodiment, the increased axial force is provided on a random basis. In a preferred embodiment, the ratio of the increased axial force to the substantially constant axial force ranges from about 5 to 40 %.

35 A method of coupling a tubular member to a preexisting structure has also been described that includes positioning the tubular member and an expansion cone within the preexisting structure, anchoring the tubular member to the preexisting

structure, and axially displacing the expansion cone relative to the expandable tubular member by pushing and pulling the expansion cone through the expandable tubular member. In a preferred embodiment, pushing the expansion cone includes: injecting a pressurized fluidic material into contact with the expansion cone.

5 A method of coupling a tubular member to a preexisting structure has also been described that includes positioning the tubular member and an expansion cone within the preexisting structure, anchoring the tubular member to the preexisting structure, axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the expandable tubular member, and injecting a  
10 curable fluidic sealing material between the tubular member and the preexisting structure prior to axially displacing the expansion cone.

A method of coupling a tubular member to a preexisting structure has also been described that includes positioning the tubular member and an expansion cone within the preexisting structure, anchoring the tubular member to the preexisting  
15 structure by increasing the size of the expansion cone, and axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member.

A method of coupling a tubular member to a preexisting structure has also been described that includes positioning the tubular member and an expansion cone within the preexisting structure, anchoring the tubular member to the preexisting  
20 structure by heating a portion of the tubular member, and axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member.

A method of coupling an expandable tubular member to a preexisting  
25 structure has also been described that includes positioning the expandable tubular member, an expansion cone, and an anchoring device within the preexisting structure, positioning the anchoring device above the expansion cone, anchoring the expandable tubular member to the preexisting structure using the anchoring device, and axially displacing the expansion cone.

30 A method of coupling an expandable tubular member to a preexisting structure has also been described that includes positioning the tubular member and an expansion cone within the preexisting structure, explosively anchoring the tubular member to the preexisting structure, and axially displacing the expansion cone relative to the tubular member.

A method of coupling an expandable tubular to a preexisting structure has also been described that includes fixing the position of an expansion cone within the preexisting structure, driving the expandable tubular member onto the expansion cone in a first direction, and axially displacing the expansion cone in a second direction relative to the expandable tubular member. In a preferred embodiment, the first and second directions are different.

A method of coupling an expandable tubular member to a preexisting structure has also been described that includes placing the expandable tubular, an expansion cone, and a resilient anchor within the preexisting structure, releasing the resilient anchor, and axially displacing the expansion cone within the expandable tubular member.

A method of coupling an expandable tubular member to a preexisting structure has also been described that includes placing the expandable tubular member, an expansion cone, and an anchor into the preexisting structure, anchoring the expandable tubular member to the preexisting structure by: pivoting one or more engagement elements, and axially displacing the expansion cone. In a preferred embodiment, pivoting the engagement elements includes: actuating the engagement elements. In a preferred embodiment, pivoting the engagement elements includes: placing a quantity of a fluidic material onto the engagement elements. In a preferred embodiment, pivoting the engagement elements includes: displacing the expandable tubular member.

A method of coupling an expandable tubular member to a preexisting structure has also been described that includes placing the expandable tubular member and an expansion cone into the preexisting structure, placing a quantity of a fluidic material onto the expandable tubular member to anchor the expandable tubular member to the preexisting structure, and axially displacing the expansion cone. In a preferred embodiment, the fluidic material comprises a barite plug. In a preferred embodiment, the fluidic material comprises a flex plug.

A method of coupling an expandable tubular member to a preexisting structure has also been described that includes positioning the expandable tubular member and an expansion cone into the preexisting structure, anchoring the expandable tubular member to the preexisting structure by injecting a quantity of a hardenable fluidic material into the preexisting structure, at least partially curing the hardenable fluidic sealing material, and axially displacing the expansion cone.

A method of coupling an expandable tubular member to a preexisting structure has also been described that includes placing the expandable tubular member and an expansion cone within the preexisting structure, and applying an axial force to the expandable tubular member in a downward direction.

5 A method of coupling an expandable tubular member to a preexisting structure has also been described that includes placing the expandable tubular member and an expansion cone within the preexisting structure, injecting a quantity of a first fluidic material having a first density into the region of the preexisting structure outside of the expandable tubular member, and injecting a quantity of a  
10 second fluidic material having a second density into a portion of the expandable tubular member below the expansion cone. In a preferred embodiment, the second density is greater than the first density.

A method of coupling an expandable tubular member to a preexisting structure has also been described that includes placing the expandable tubular  
15 member and an expansion cone into the preexisting structure, anchoring the expandable tubular member to the preexisting structure, applying an axial force to the expansion cone, and pressurizing an interior portion of the expandable tubular member below the expansion cone.

A method of coupling an expandable tubular member to a preexisting  
20 structure has also been described that includes placing the expandable tubular member and an expansion cone into the preexisting structure, and applying an axial force to the expandable tubular member.

An apparatus for coupling a tubular member to a preexisting structure has also been described that includes an expandable tubular member, an anchoring  
25 device adapted to couple the expandable tubular member to the preexisting structure, and an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member, including: a housing including a tapered first end and a second end, one or more grooves formed in the outer surface of the tapered first end, and one or more axial flow  
30 passages fluidically coupled to the grooves. In a preferred embodiment, the grooves include circumferential grooves. In a preferred embodiment, the grooves include spiral grooves. In a preferred embodiment, the grooves are concentrated around the axial midpoint of the tapered portion of the housing. In a preferred embodiment, the axial flow passages include axial grooves. In a preferred embodiment, the axial  
35 grooves are spaced apart by at least about 3 inches in the circumferential direction.

In a preferred embodiment, the axial grooves extend from the tapered first end of the body to the grooves. In a preferred embodiment, the axial grooves extend from the second end of the body to the grooves. In a preferred embodiment, the axial grooves extend from the tapered first end of the body to the second end of the body.

5 In a preferred embodiment, the axial flow passages are positioned within the housing of the expansion cone. In a preferred embodiment, the axial flow passages extend from the tapered first end of the body to the grooves. In a preferred embodiment, the axial flow passages extend from the tapered first end of the body to the second end of the body. In a preferred embodiment, the axial flow passages

10 extend from the second end of the body to the grooves. In a preferred embodiment, one or more of the flow passages include inserts having restricted flow passages. In a preferred embodiment, one or more of the axial flow passages include filters. In a preferred embodiment, the cross sectional area of the grooves is greater than the cross sectional area of the axial flow passages. In a preferred embodiment, the

15 cross-sectional area of the grooves ranges from about  $2 \times 10^{-4} \text{ in}^2$  to  $5 \times 10^{-2} \text{ in}^2$ . In a preferred embodiment, the cross-sectional area of the axial flow passages ranges from about  $2 \times 10^{-4} \text{ in}^2$  to  $5 \times 10^{-2} \text{ in}^2$ . In a preferred embodiment, the angle of attack of the first tapered end of the body ranges from about 10 to 30 degrees. In a preferred embodiment, the grooves are concentrated in a trailing edge portion of the

20 tapered first end. In a preferred embodiment, the angle of inclination of the axial flow passages relative to the longitudinal axis of the expansion cone is greater than the angle of attack of the first tapered end. In a preferred embodiment, the grooves include: a flow channel having a first radius of curvature, a first shoulder positioned on one side of the flow channel having a second radius of curvature, and a second

25 shoulder positioned on the other side of the flow channel having a third radius of curvature. In a preferred embodiment, the first, second and third radii of curvature are substantially equal. In a preferred embodiment, the axial flow passages include: a flow channel having a first radius of curvature, a first shoulder positioned on one side of the flow channel having a second radius of curvature, and a second shoulder

30 positioned on the other side of the flow channel having a third radius of curvature. In a preferred embodiment, the first, second and third radii of curvature are substantially equal. In a preferred embodiment, the second radius of curvature is greater than the third radius of curvature.

35 An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes an expandable tubular member, an

anchoring device adapted to couple the expandable tubular member to the preexisting structure, and an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member. In a preferred embodiment, the expandable tubular member includes: an annular member, having: a wall thickness that varies less than about 8 %, a hoop yield strength that varies less than about 10 %; imperfections of less than about 8 % of the wall thickness, no failure for radial expansions of up to about 30 %, and no necking of the walls of the annular member for radial expansions of up to about 25%.

10 An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes an expandable tubular member, an anchoring device adapted to couple the expandable tubular member to the preexisting structure, and an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member. In  
15 a preferred embodiment, the expandable tubular member includes: a first tubular member, a second tubular member, and a threaded connection for coupling the first tubular member to the second tubular member. In a preferred embodiment, the threaded connection includes: one or more sealing members for sealing the interface between the first and second tubular members. In a preferred  
20 embodiment, the threaded connection comprises a pin and box threaded connection. In a preferred embodiment, the sealing members are positioned adjacent to an end portion of the threaded connection. In a preferred embodiment, one of the sealing members is positioned adjacent to an end portion of the threaded connection, and another one of the sealing members is not positioned adjacent to an end portion of the threaded connection. In a preferred embodiment, the plurality  
25 of the sealing members are positioned adjacent to an end portion of the threaded connection.

An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes an expandable tubular member, an  
30 anchoring device adapted to couple the expandable tubular member to the preexisting structure, and an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member. In a preferred embodiment, the expandable tubular member includes: a layer of a lubricant coupled to the interior surface of the tubular member. In a preferred  
35 embodiment, the lubricant comprises a metallic soap. In a preferred embodiment,

the lubricant is selected from the group consisting of C-Lube-10, C-PHOS-58-M, and C-PHOS-58-R. In a preferred embodiment, the lubricant provides a sliding friction coefficient of less than about 0.20. In a preferred embodiment, the lubricant is chemically bonded to the interior surface of the expandable tubular member. In a preferred embodiment, the lubricant is mechanically bonded to the interior surface of the expandable tubular member. In a preferred embodiment, the lubricant is adhesively bonded to the interior surface of the expandable tubular member. In a preferred embodiment, the lubricant includes epoxy, molybdenum disulfide, graphite, aluminum, copper, aluminosilicate and polyethylenepolyamine.

10 An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes an expandable tubular member, an anchoring device adapted to couple the expandable tubular member to the preexisting structure, and an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member. In a preferred embodiment, the expandable tubular member includes: a pair of tubular members having threaded portions coupled to one another, and a quantity of a sealant within the threaded portions of the tubular members. In a preferred embodiment, the sealant is selected from the group consisting of epoxies, thermosetting sealing compounds, curable sealing compounds, and sealing compounds having polymerizable materials. In a preferred embodiment, the sealant includes an initial cure cycle and a final cure cycle. In a preferred embodiment, the sealant can be stretched up to about 30 to 40 percent without failure. In a preferred embodiment, the sealant is resistant to conventional wellbore fluidic materials. In a preferred embodiment, the material properties of the sealant are substantially stable for temperatures ranging from about 0 to 450 °F. In a preferred embodiment, the threaded portions of the tubular members include a primer for improving the adhesion of the sealant to the threaded portions.

30 An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes an expandable tubular member, an anchoring device adapted to couple the expandable tubular member to the preexisting structure, and an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member. In a preferred embodiment, the expandable tubular member includes: a pair of rings for engaging the preexisting structure, and a sealing element positioned between the

rings for sealing the interface between the tubular member and the preexisting structure.

An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes an expandable tubular member, an  
5 anchoring device adapted to couple the expandable tubular member to the preexisting structure, and an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member. In a preferred embodiment, the expandable tubular member includes one or more slots. In a preferred embodiment, the slots are provided at a preexpanded portion of  
10 the expandable tubular member. In a preferred embodiment, the slots are provided at a non-preexpanded portion of the tubular member.

An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes an expandable tubular member, an anchoring device adapted to couple the expandable tubular member to the  
15 preexisting structure, and an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member. In a preferred embodiment, the expandable tubular member includes: a first preexpanded portion, an intermediate portion coupled to the first preexpanded portion including a sealing element, and a second preexpanded portion coupled to  
20 the intermediate portion.

An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes an expandable tubular member, an anchoring device adapted to couple the expandable tubular member to the preexisting structure, an expansion cone movably coupled to the expandable tubular  
25 member and adapted to radially expand the expandable tubular member, and a valveable fluid passage coupled to the anchoring device.

An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a first support member, a second support member coupled to the first support member, an expansion cone coupled to  
30 the first support member, an expandable tubular member coupled to the expansion cone, and an anchoring device coupled to the second support member adapted to couple the expandable tubular member to the preexisting structure. In a preferred embodiment, the anchoring device is positioned above the expansion cone. In a preferred embodiment, the outside diameter of the expansion cone is greater than  
35 the inside diameter of the expandable tubular member. In a preferred embodiment,

the outside diameter of the expansion cone is approximately equal to the outside diameter of the expandable tubular member.

5 An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a first support member, a second support member coupled to the first support member, an expansion cone coupled to the first support member, an expandable tubular member coupled to the expansion cone, and an explosive anchoring device coupled to the second support member adapted to couple the expandable tubular member to the preexisting structure.

10 An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a support member, an expandable expansion cone coupled to the support member, and an expandable tubular member coupled to the expansion cone.

15 An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a support member, an expandable expansion cone coupled to the support member, and an expandable tubular member coupled to the expandable expansion cone. In a preferred embodiment, the expandable tubular member includes one or more anchoring devices. In a preferred embodiment, the expandable tubular member includes a slotted end portion.

20 An apparatus for coupling an expandable tubular to a preexisting structure has also been described that includes a support member, an expansion cone coupled to the support member, an expandable tubular member coupled to the expansion cone including one or more shape memory metal inserts, and a heater coupled to the support member in opposing relation to the shape memory metal inserts.

25 An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a support member, an expansion cone coupled to the support member, an expandable tubular member coupled to the expandable expansion cone, and a resilient anchor coupled to the expandable tubular member. In a preferred embodiment, the resilient anchor includes a resilient scroll. In a preferred embodiment, the resilient anchor includes one or more resilient arms. In a preferred embodiment, the resilient anchor includes one or more resilient radially oriented elements. In a preferred embodiment, the resilient anchor is adapted to mate with the expansion cone.

An expandable tubular member has also been described that includes an expandable tubular body, one or more resilient panels coupled to the expandable tubular body, and a release member releasably coupled to the resilient panels adapted to controllably release the resilient panels.

- 5        An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a support member, an expansion cone coupled to the support member, an expandable tubular member coupled to the expandable expansion cone, and an anchor coupled to the expandable tubular member, including: one or more spikes pivotally coupled to the expandable tubular member for engaging the preexisting structure. In a preferred embodiment, the apparatus further includes one or more corresponding actuators for pivoting the spikes.

- 10        An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a support member, an expansion cone coupled to the support member, an expandable tubular member coupled to the expandable expansion cone, and an anchor coupled to the expandable tubular member, including: one or more petal baskets pivotally coupled to the expandable tubular member. In a preferred embodiment, the apparatus further includes one or more corresponding actuators for pivoting the petal baskets.

- 15        An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a support member, an expansion cone coupled to the support member, an expandable tubular member coupled to the expansion cone, including: a slotted portion provided at one end of the expandable tubular member.

- 20        An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a support member, an expansion cone, an expandable tubular member coupled to the expansion cone, a coupling device coupled to the support member and an end portion of the expandable tubular member, and a mass coupled to the end portion of the expandable tubular member.
- 25        In a preferred embodiment, the weight of the mass is greater than about 50 to 100 % of the yield strength of the expandable tubular member.

- 30        An apparatus for coupling an expandable tubular member to a preexisting structure has also been described that includes a support member including a fluid passage, an expansion cone coupled to the support member, an expandable tubular member coupled to the expansion cone, a slip joint coupled to the expansion cone,
- 35

an end plate coupled to the slip joint, a fluid chamber coupled to the fluid passage, the fluid chamber defined by the interior portion of the expandable tubular member between the expansion cone and the end plate.

5 A method of coupling a tubular member to a preexisting structure has been described that includes positioning the tubular member and an expansion cone within the preexisting structure, axially displacing the expansion cone, removing the expansion cone, and applying direct radial pressure to the first tubular member. In a preferred embodiment, axially displacing the expansion cone includes pressurizing at least a portion of the interior of the tubular member. In a preferred embodiment,  
10 axially displacing the expansion cone includes: injecting a fluidic material into the tubular member. In a preferred embodiment, axially displacing the expansion cone includes: applying a tensile force to the expansion cone. In a preferred embodiment, axially displacing the expansion cone includes: displacing the expansion cone into the tubular member. In a preferred embodiment, axially  
15 displacing the expansion cone includes: displacing the expansion cone out of the tubular member. In a preferred embodiment, axially displacing the expansion cone radially expands the tubular member by about 10% to 20%. In a preferred embodiment, applying direct radial pressure to the first tubular member radially expands the tubular member by up to about 5%. In a preferred embodiment,  
20 applying direct radial pressure to the tubular member includes applying a radial force at discrete locations. In a preferred embodiment, the preexisting structure includes a wellbore casing. In a preferred embodiment, the preexisting structure includes a pipeline. In a preferred embodiment, the preexisting structure includes a structural support.

25 An apparatus also has been described that includes a tubular member coupled to a preexisting structure. The tubular member is coupled to the preexisting structure by the process of: positioning the tubular member and an expansion cone within the preexisting structure, axially displacing the expansion cone, removing the expansion cone, and applying direct radial pressure to the tubular member. In a preferred embodiment, axially displacing the expansion cone includes: pressurizing  
30 at least a portion of the interior of the tubular member. In a preferred embodiment, axially displacing the expansion cone includes: injecting a fluidic material into the tubular member. In a preferred embodiment, axially displacing the expansion cone includes: applying a tensile force to the expansion cone. In a preferred  
35 embodiment, axially displacing the expansion cone includes: displacing the

- expansion cone into the tubular member. In a preferred embodiment, axially displacing the expansion cone includes: displacing the expansion cone out of the tubular member. In a preferred embodiment, axially displacing the expansion cone radially expands the tubular member by about 10% to 20%. In a preferred embodiment, applying direct radial pressure to the tubular member radially expands the tubular member by up to about 5%. In a preferred embodiment, applying direct radial pressure to the tubular member includes applying a radial force at discrete locations. In a preferred embodiment, the preexisting structure includes a wellbore casing. In a preferred embodiment, the preexisting structure includes a pipeline. In a preferred embodiment, the preexisting structure includes a structural support.

Although this detailed description has shown and described illustrative embodiments of the invention, this description contemplates a wide range of modifications, changes, and substitutions. In some instances, one may employ some features of the present invention without a corresponding use of the other features. Accordingly, it is appropriate that readers should construe the appended claims broadly, and in a manner consistent with the scope of the invention.

## **CLAIMS**

1. An apparatus for coupling a tubular member to a preexisting structure, comprising:

an expandable tubular member;

5 an anchoring device adapted to couple the expandable tubular member to the preexisting structure; and

an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member, including:

a housing including a tapered first end and a second end;

10 one or more grooves formed in the outer surface of the tapered first end; and one or more axial flow passages fluidly coupled to the grooves.

2. The apparatus of claim 1, wherein the grooves comprise circumferential grooves.

15

3. The apparatus of claim 1, wherein the grooves comprise spiral grooves.

4. The apparatus of claim 1, wherein the grooves are concentrated around the axial midpoint of the tapered portion of the housing.

20

5. The apparatus of claim 1, wherein the axial flow passages comprise axial grooves.

6. The apparatus of claim 5, wherein the axial grooves are spaced apart by at least 3 inches in the circumferential direction.

25

7. The apparatus of claim 5, wherein the axial grooves extend from the tapered first end of the body to the grooves.

8. The apparatus of claim 5, wherein the axial grooves extend from the second end of the body to the grooves.

30

9. The apparatus of claim 5, wherein the axial grooves extend from the tapered first end of the body to the second end of the body.

35

10. The apparatus of claim 1, wherein the axial flow passages are positioned within the housing of the expansion cone.
11. The apparatus of claim 10, wherein the axial flow passages extend from the tapered first end of the body to the grooves.
12. The apparatus of claim 10, wherein the axial flow passages extend from the tapered first end of the body to the second end of the body.
13. The apparatus of claim 12, wherein the axial flow passages extend from the second end of the body to the grooves.
14. The apparatus of claim 12, wherein one or more of the flow passages include inserts having restricted flow passages.
15. The apparatus of claim 12, wherein one or more of the axial flow passages include filters.
16. The apparatus of claim 1, wherein the cross sectional area of the grooves is greater than the cross sectional area of the axial flow passages.
17. The apparatus of claim 1, wherein the cross-sectional area of the grooves ranges from  $2 \times 10^{-4} \text{ in}^2$  to  $5 \times 10^{-2} \text{ in}^2$ .
18. The apparatus of claim 1, wherein the cross-sectional area of the axial flow passages ranges from  $2 \times 10^{-4} \text{ in}^2$  to  $5 \times 10^{-2} \text{ in}^2$ .
19. The apparatus of claim 1, wherein the angle of attack of the first tapered end of the body ranges from 10 to 30 degrees.
20. The apparatus of claim 1, wherein the grooves are concentrated in a trailing edge portion of the tapered first end.

21. The apparatus of claim 1, wherein the angle of inclination of the axial flow passages relative to the longitudinal axis of the expansion cone is greater than the angle of attack of the first tapered end.
- 5 22. The apparatus of claim 1, wherein the grooves include:  
a flow channel having a first radius of curvature;  
a first shoulder positioned on one side of the flow channel having a second  
radius of curvature; and  
a second shoulder positioned on the other side of the flow channel having a  
10 third radius of curvature.
23. The apparatus of claim 22, wherein the first, second and third radii of curvature are substantially equal.
- 15 24. The apparatus of claim 1, wherein the axial flow passages include:  
a flow channel having a first radius of curvature;  
a first shoulder positioned on one side of the flow channel having a second  
radius of curvature; and  
a second shoulder positioned on the other side of the flow channel having a  
20 third radius of curvature.
25. The apparatus of claim 24, wherein the first, second and third radii of curvature are substantially equal.
- 25 26. The apparatus of claim 24, wherein the second radius of curvature is greater than the third radius of curvature.
27. The apparatus of claim 1, wherein the expandable tubular member includes:  
an annular member, having:  
30 a wall thickness that varies less than 8 %;  
a hoop yield strength that varies less than 10 %;  
imperfections of less than 8 % of the wall thickness;  
no failure for radial expansions of up to 30 %; and  
no necking of the walls of the annular member for radial expansions of up to  
35 25%.

28. The apparatus of claim 1, wherein the expandable tubular member includes:  
a first tubular member;  
a second tubular member; and  
5 a pin and box threaded connection for coupling the first tubular member to  
the second tubular member, the threaded connection including:  
one or more sealing members for sealing the interface between the first and  
second tubular members.
- 10 29. The apparatus of claim 28, wherein the sealing members are positioned  
adjacent to an end portion of the threaded connection.
30. The apparatus of claim 28, wherein one of the sealing members is positioned  
adjacent to an end portion of the threaded connection; and wherein another one of  
15 the sealing members is not positioned adjacent to an end portion of the threaded  
connection.
31. The apparatus of claim 28, wherein a plurality of the sealing members are  
positioned adjacent to an end portion of the threaded connection.
- 20 32. The apparatus of claim 1, wherein the expandable tubular member includes:  
a layer of a lubricant bonded to the interior surface of the tubular member.
33. The apparatus of claim 32, wherein the lubricant comprises a metallic soap.
- 25 34. The apparatus of claim 32, wherein the lubricant is selected from the group  
consisting of C-Lube-10, C-PHOS-58-M, and C-PHOS-58-R.
35. The apparatus of claim 32, wherein the lubricant provides a sliding friction  
30 coefficient of less than 0.20.
36. The apparatus of claim 32, wherein the lubricant is chemically bonded to the  
interior surface of the expandable tubular member.

37. The apparatus of claim 32, wherein the lubricant is mechanically bonded to the interior surface of the expandable tubular member.

38. The apparatus of claim 32, wherein the lubricant is adhesively bonded to the interior surface of the expandable tubular member.

39. The apparatus of claim 38, wherein the lubricant includes epoxy, molybdenum disulfide, graphite, aluminum, copper, aluminosilicate and polyethylenepolyamine.

40. The apparatus of claim 1, wherein the expandable tubular member includes: a pair of tubular members having threaded portions coupled to one another; and a quantity of a sealant within the threaded portions of the tubular members.

41. The apparatus of claim 40, wherein the sealant is selected from the group consisting of epoxies, thermosetting sealing compounds, curable sealing compounds, and sealing compounds having polymerizable materials.

42. The apparatus of claim 40, wherein the sealant includes an initial cure cycle and a final cure cycle.

43. The apparatus of claim 40, wherein the sealant can be stretched up to 30 to 40 percent without failure.

44. The apparatus of claim 40, wherein the sealant is resistant to conventional wellbore fluidic materials.

45. The apparatus of claim 40, wherein the material properties of the sealant are substantially stable for temperatures ranging from 0 to 450°F.

46. The apparatus of claim 40, wherein the threaded portions of the tubular members include a primer for improving the adhesion of the sealant to the threaded portions.

47. The apparatus of claim 1, wherein the expandable tubular member includes:  
a pair of rings for engaging the preexisting structure; and  
a sealing element positioned between the rings for sealing the interface  
between the tubular member and the preexisting structure.
- 5
48. The apparatus of claim 1, wherein the expandable tubular member includes:  
a first preexpanded portion;  
an intermediate portion coupled to the first preexpanded portion including a  
sealing element; and  
10 a second preexpanded portion coupled to the intermediate portion.
49. The apparatus of claim 1, further comprising:  
a valveable fluid passage coupled to the anchoring device.
- 15 50. The apparatus of claim 1, wherein the anchoring device comprises an  
explosive anchoring device.
51. The apparatus of claim 1, wherein the expandable tubular member includes  
one or more shape memory metal inserts; and the apparatus includes a heater in  
20 opposing relation to the shape memory metal inserts.
52. The apparatus of claim 1, wherein the anchoring device includes a resilient  
anchor coupled to the expandable tubular member.
- 25 53. The apparatus of claim 52, wherein the resilient anchor includes:  
a resilient scroll.
54. The apparatus of claim 52, wherein the resilient anchor includes:  
one or more resilient arms.  
30
55. The apparatus of claim 52, wherein the resilient anchor includes:  
one or more resilient radially oriented elements.
56. The apparatus of claim 52, wherein the resilient anchor is adapted to mate  
35 with the expansion cone.

57. The apparatus of claim 1, wherein the expandable tubular member includes:  
an expandable tubular body;  
one or more resilient panels coupled to the expandable tubular body; and  
5 a release member releasably coupled to the resilient panels adapted to  
controllably release the resilient panels.
58. The apparatus of claim 1, wherein the anchoring device includes an anchor  
coupled to the expandable tubular member, including:  
10 one or more spikes pivotally coupled to the expandable tubular member for  
engaging the preexisting structure.
59. The apparatus of claim 58, further including one or more corresponding  
actuators for pivoting the spikes.  
15
60. The apparatus of claim 1, wherein the anchoring device includes an anchor  
coupled to the expandable tubular member, including:  
one or more petal baskets pivotally coupled to the expandable tubular  
member.  
20
61. The apparatus of claim 60, further including one or more corresponding  
actuators for pivoting the petal baskets.
62. The apparatus of claim 1, further comprising:  
25 a support member including a fluid passage, the expansion cone coupled to  
the support member, the expandable tubular member coupled to the expansion  
cone;  
a slip joint coupled to the expansion cone;  
an end plate coupled to the slip joint;  
30 a fluid chamber coupled to the fluid passage, the fluid chamber defined by  
the interior portion of the expandable tubular member between the expansion cone  
and the end plate.
63. The apparatus of claim 1, wherein the expandable tubular member includes:  
35 a slotted end portion.

1. A method of coupling an expandable tubular member to a preexisting structure, comprising:
  - positioning the tubular member and an expansion cone within the preexisting
  - 5 structure;
  - anchoring the tubular member to the preexisting structure;
  - axially displacing the expansion cone relative to the tubular member by
  - pulling the expansion cone through the tubular member; and
  - lubricating the interface between the expansion cone and the tubular
  - 10 member.
2. The method of claim 1, wherein lubricating the interface between the expansion cone and the tubular member includes:
  - injecting a lubricating fluid into the trailing edge of the interface between the
  - 15 expansion cone and the tubular member.
3. The method of claim 2, wherein the lubricating fluid has a viscosity ranging from about 1 to 10,000 centipoise.
- 20 4. The method of claim 2, wherein the injecting includes:
  - injecting lubricating fluid into a tapered end of the expansion cone.
5. The method of claim 2, wherein the injecting includes:
  - injecting lubricating fluid into the area around the axial midpoint of a first
  - 25 tapered end of the expansion cone.
6. The method of claim 2, wherein the injecting includes:
  - injecting lubricating fluid into a second end of the expansion cone.
- 30 7. The method of claim 2, wherein the injecting includes:
  - injecting lubricating fluid into a tapered first end and a second end of the expansion cone.
8. The method of claim 2, wherein the injecting includes:
  - 35 injecting lubricating fluid into an interior of the expansion cone.

9. The method of claim 2, wherein the injecting includes:  
injecting lubricating fluid through an outer surface of the expansion cone.
- 5 10. The method of claim 2, wherein the injecting includes:  
injecting the lubricating fluid into a plurality of discrete locations along the  
trailing edge portion.
- 10 11. The method of claim 2, wherein the lubricating fluid comprises:  
drilling mud.
12. The method of claim 2, wherein the lubricating fluid further includes:  
TorqTrim III;  
EP Mudlib; and  
15 DrillN-Sild.
13. The method of claim 2, wherein the lubricating fluid comprises:  
TorqTrim III;  
EP Mudlib; and  
20 DrillN-Sild.
14. The method of claim 1, wherein lubricating the interface between the  
expansion cone and the tubular member includes:  
coating the interior surface of the tubular member with a lubricant.  
25
15. The method of claim 1, wherein lubricating the interface between the  
expansion cone and the tubular member includes:  
coating the interior surface of the tubular member with a first part of a  
lubricant; and  
30 applying a second part of the lubricant to the interior surface of the tubular  
member.
16. The method of claim 14, wherein the lubricant comprises a metallic soap.

17. The method of claim 14, wherein the lubricant is selected from the group consisting of C-Lube-10, C-PHOS-58-M, and C-PHOS-58-R.
18. The method of claim 14, wherein the lubricant provides a sliding friction coefficient of less than about 0.20.
19. The method of claim 14, wherein the lubricant is chemically bonded to the interior surfaces of the tubular members.
20. The method of claim 14, wherein the lubricant is mechanically bonded to the interior surfaces of the tubular members.
21. The method of claim 14, wherein the lubricant is adhesively bonded to the interior surface of the tubular members.
22. The method of claim 14, wherein the lubricant includes epoxy, molybdenum disulfide, graphite, aluminum, copper, aluminosilicate and polyethylenepolyamine.
23. A method of coupling a tubular member to a preexisting structure, comprising:  
positioning the tubular member and an expansion cone within the preexisting structure;  
anchoring the tubular member to the preexisting structure; and  
axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member;  
wherein the tubular member includes:  
an annular member, including:  
a wall thickness that varies less than about 8 %;  
a hoop yield strength that varies less than about 10 %;  
imperfections of less than about 8 % of the wall thickness;  
no failure for radial expansions of up to about 30 %; and  
no necking of the walls of the annular member for radial expansions of up to about 25%.

24. A method of coupling a tubular member to a preexisting structure, comprising:
- injecting a lubricating fluid into the preexisting structure;
  - positioning the tubular member and an expansion cone within the preexisting structure;
  - anchoring the tubular member to the preexisting structure; and
  - axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member.
25. The method of claim 24, wherein the lubricating fluid comprises: BARO-LUB GOLD-SEAL™ brand drilling mud lubricant.
26. A method of coupling an expandable tubular member to a preexisting structure, comprising:
- positioning the expandable tubular member and an expansion cone within the preexisting structure;
  - anchoring the expandable tubular member to the preexisting structure; and
  - axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member;
- wherein the expandable tubular member includes:
- a first tubular member;
  - a second tubular member; and
  - a threaded connection for coupling the first tubular member to the second tubular member, the threaded connection including:
- one or more sealing members for sealing the interface between the first and second tubular members.
27. The method of claim 26, wherein the threaded connection comprises a pin and box threaded connection.
28. The method of claim 26, wherein the sealing members are positioned adjacent to an end portion of the threaded connection.
29. The method of claim 26, wherein one of the sealing members is positioned adjacent to an end portion of the threaded connection; and wherein another one of

the sealing members is not positioned adjacent to an end portion of the threaded connection.

30. The method of claim 26, wherein a plurality of the sealing members are positioned adjacent to an end portion of the threaded connection.

31. A method of coupling an expandable tubular member to a preexisting structure, comprising:

positioning the expandable tubular member and an expansion cone within the preexisting structure;  
anchoring the expandable tubular member to the preexisting structure; and  
axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member;  
wherein the expandable tubular member includes a plurality of tubular members having threaded portions that are coupled to one another by the process of:  
coating the threaded portions of the tubular members with a sealant;  
coupling the threaded portions of the tubular members; and  
curing the sealant.

32. The method of claim 31, wherein the sealant is selected from the group consisting of epoxies, thermosetting sealing compounds, curable sealing compounds, and sealing compounds having polymerizable materials.

33. The method of claim 31, further including:  
initially curing the sealant prior to radially expanding the tubular members;  
and  
finally curing the sealant after radially expanding the tubular members.

34. The method of claim 31, wherein the sealant can be stretched up to about 30 to 40 percent after curing without failure.

35. The method of claim 31, wherein the sealant is resistant to conventional wellbore fluidic materials.

36. The method of claim 31, wherein the material properties of the sealant are substantially stable for temperatures ranging from about 0 to 450 °F.
37. The method of claim 31, further including:  
5       applying a primer to the threaded portions of the tubular members prior to coating the threaded portions of the tubular members with the sealant.
38. The method of claim 37, wherein the primer includes a curing catalyst.
- 10   39. The method of claim 37, wherein the primer is applied to the threaded portion of one of the tubular members and the sealant is applied to the threaded portion of the other one of the tubular members.
40. The method of claim 37, wherein the primer includes a curing catalyst.
- 15   41. A method of coupling a tubular member to a preexisting structure, comprising:  
      positioning the tubular member and an expansion cone within the preexisting structure;  
20       anchoring the tubular member to the preexisting structure; and  
      axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the expandable tubular member;  
      wherein the tubular member includes:  
      a pair of rings for engaging the preexisting structure; and  
25       a sealing element positioned between the rings for sealing the interface between the tubular member and the preexisting structure.
42. A method of coupling a tubular member to a preexisting structure, comprising:  
30       positioning the expandable tubular member and an expansion cone within the preexisting structure;  
      anchoring the expandable tubular member to the preexisting structure; and  
      axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member;  
35       wherein the tubular member includes one or more slots.

43. The method of claim 42, wherein the slots are provided at a preexpanded portion of the tubular member.

5 44. The method of claim 42, wherein the slots are provided at a non-preexpanded portion of the tubular member.

45. A method of coupling a tubular member to a preexisting structure, comprising:

- 10 positioning the expandable tubular member and an expansion cone within the preexisting structure;
- anchoring the expandable tubular member to the preexisting structure; and
- axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member;
- 15 wherein the tubular member includes:
- a first preexpanded portion;
- an intermediate portion coupled to the first preexpanded portion including a sealing element; and
- a second preexpanded portion coupled to the intermediate portion.

20

46. A method of coupling a tubular member to a preexisting structure, comprising:

- positioning the expandable tubular member and an expansion cone within the preexisting structure;
- 25 anchoring the expandable tubular member to the preexisting structure; and
- axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member by applying an axial force to the expansion cone;
- wherein the axial force includes:
- 30 a substantially constant axial force; and
- an increased axial force.

47. The method of claim 46, wherein the increased axial force is provided on a periodic basis.

35

48. The method of claim 46, wherein the increased axial force is provided on a random basis.

49. The method of claim 46, wherein the ratio of the increased axial force to the substantially constant axial force ranges from about 5 to 40 %.

51. A method of coupling a tubular member to a preexisting structure, comprising:

positioning the tubular member and an expansion cone within the preexisting structure;  
anchoring the tubular member to the preexisting structure; and  
axially displacing the expansion cone relative to the expandable tubular member by pushing and pulling the expansion cone through the expandable tubular member.

52. The method of claim 51, wherein pushing the expansion cone includes: injecting a pressurized fluidic material into contact with the expansion cone.

53. A method of coupling a tubular member to a preexisting structure, comprising:

positioning the tubular member and an expansion cone within the preexisting structure;  
anchoring the tubular member to the preexisting structure;  
axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the expandable tubular member; and  
injecting a curable fluidic sealing material between the tubular member and the preexisting structure prior to axially displacing the expansion cone.

54. A method of coupling a tubular member to a preexisting structure, comprising:

positioning the tubular member and an expansion cone within the preexisting structure;  
anchoring the tubular member to the preexisting structure by increasing the size of the expansion cone; and

axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member.

55. A method of coupling a tubular member to a preexisting structure,  
5 comprising:

positioning the tubular member and an expansion cone within the preexisting structure;

anchoring the tubular member to the preexisting structure by heating a portion of the tubular member; and

10 axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member.

56. A method of coupling an expandable tubular member to a preexisting structure, comprising:

15 positioning the expandable tubular member, an expansion cone, and an anchoring device within the preexisting structure;

positioning the anchoring device above the expansion cone;

anchoring the expandable tubular member to the preexisting structure using the anchoring device; and

20 axially displacing the expansion cone.

57. A method of coupling an expandable tubular member to a preexisting structure, comprising:

25 positioning the tubular member and an expansion cone within the preexisting structure;

explosively anchoring the tubular member to the preexisting structure; and

axially displacing the expansion cone relative to the tubular member.

58. A method of coupling an expandable tubular to a preexisting structure,  
30 comprising:

fixing the position of an expansion cone within the preexisting structure;

driving the expandable tubular member onto the expansion cone in a first direction; and

35 axially displacing the expansion cone in a second direction relative to the expandable tubular member;

wherein the first and second directions are different.

59. A method of coupling an expandable tubular member to a preexisting structure, comprising:

- 5        placing the expandable tubular, an expansion cone, and a resilient anchor within the preexisting structure;  
         releasing the resilient anchor; and  
         axially displacing the expansion cone within the expandable tubular member.

10    60. A method of coupling an expandable tubular member to a preexisting structure, comprising:

- placing the expandable tubular member, an expansion cone, and an anchor into the preexisting structure;  
         anchoring the expandable tubular member to the preexisting structure by:  
15        pivoting one or more engagement elements; and  
         axially displacing the expansion cone.

         61. The method of claim 60, wherein pivoting the engagement elements includes:  
20        actuating the engagement elements.

         62. The method of claim 60, wherein pivoting the engagement elements includes:  
         placing a quantity of a fluidic material onto the engagement elements.

25        63. The method of claim 60, wherein pivoting the engagement elements includes:  
         displacing the expandable tubular member.

30    64. A method of coupling an expandable tubular member to a preexisting structure, comprising:

- placing the expandable tubular member and an expansion cone into the preexisting structure;  
         placing a quantity of a fluidic material onto the expandable tubular member to  
35    anchor the expandable tubular member to the preexisting structure; and

axially displacing the expansion cone.

65. The method of claim 64, wherein the fluidic material comprises a barite plug.

5 66. The method of claim 64, wherein the fluidic material comprises a flex plug.

67. A method of coupling an expandable tubular member to a preexisting structure, comprising:

10 positioning the expandable tubular member and an expansion cone into the preexisting structure;

anchoring the expandable tubular member to the preexisting structure by injecting a quantity of a hardenable fluidic material into the preexisting structure; at least partially curing the hardenable fluidic sealing material; and axially displacing the expansion cone.

15

68. A method of coupling an expandable tubular member to a preexisting structure, comprising:

placing the expandable tubular member and an expansion cone within the preexisting structure; and

20 applying an axial force to the expandable tubular member in a downward direction.

69. A method of coupling an expandable tubular member to a preexisting structure, comprising:

25 placing the expandable tubular member and an expansion cone within the preexisting structure;

injecting a quantity of a first fluidic material having a first density into the region of the preexisting structure outside of the expandable tubular member; and

30 injecting a quantity of a second fluidic material having a second density into a portion of the expandable tubular member below the expansion cone; wherein the second density is greater than the first density.

70. A method of coupling an expandable tubular member to a preexisting structure, comprising:

placing the expandable tubular member and an expansion cone into the preexisting structure;

anchoring the expandable tubular member to the preexisting structure;

applying an axial force to the expansion cone; and

5       pressurizing an interior portion of the expandable tubular member below the expansion cone.

71.   A method of coupling an expandable tubular member to a preexisting structure, comprising:

10       placing the expandable tubular member and an expansion cone into the preexisting structure; and

applying an axial force to the expandable tubular member.

72.   An apparatus for coupling a tubular member to a preexisting structure, comprising:

15       an expandable tubular member;

an anchoring device adapted to couple the expandable tubular member to the preexisting structure; and

20       an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member, including:

a housing including a tapered first end and a second end;

one or more grooves formed in the outer surface of the tapered first end; and one or more axial flow passages fluidly coupled to the grooves.

25   73.   The apparatus of claim 72, wherein the grooves comprise circumferential grooves.

74.   The apparatus of claim 72, wherein the grooves comprise spiral grooves.

30   75.   The apparatus of claim 72, wherein the grooves are concentrated around the axial midpoint of the tapered portion of the housing.

76.   The apparatus of claim 72, wherein the axial flow passages comprise axial grooves.

35

77. The apparatus of claim 76, wherein the axial grooves are spaced apart by at least about 3 inches in the circumferential direction.
78. The apparatus of claim 76, wherein the axial grooves extend from the tapered first end of the body to the grooves.
79. The apparatus of claim 76, wherein the axial grooves extend from the second end of the body to the grooves.
80. The apparatus of claim 76, wherein the axial grooves extend from the tapered first end of the body to the second end of the body.
81. The apparatus of claim 72, wherein the axial flow passages are positioned within the housing of the expansion cone.
82. The apparatus of claim 81, wherein the axial flow passages extend from the tapered first end of the body to the grooves.
83. The apparatus of claim 81, wherein the axial flow passages extend from the tapered first end of the body to the second end of the body.
84. The apparatus of claim 83, wherein the axial flow passages extend from the second end of the body to the grooves.
85. The apparatus of claim 83, wherein one or more of the flow passages include inserts having restricted flow passages.
86. The apparatus of claim 83, wherein one or more of the axial flow passages include filters.
87. The apparatus of claim 72, wherein the cross sectional area of the grooves is greater than the cross sectional area of the axial flow passages.
88. The apparatus of claim 72, wherein the cross-sectional area of the grooves ranges from about  $2 \times 10^{-4}$  in<sup>2</sup> to  $5 \times 10^{-2}$  in<sup>2</sup>.

89. The apparatus of claim 72, wherein the cross-sectional area of the axial flow passages ranges from about  $2 \times 10^{-4} \text{ in}^2$  to  $5 \times 10^{-2} \text{ in}^2$ .
- 5 90. The apparatus of claim 72, wherein the angle of attack of the first tapered end of the body ranges from about 10 to 30 degrees.
91. The apparatus of claim 72, wherein the grooves are concentrated in a trailing edge portion of the tapered first end.
- 10 92. The apparatus of claim 72, wherein the angle of inclination of the axial flow passages relative to the longitudinal axis of the expansion cone is greater than the angle of attack of the first tapered end.
- 15 93. The apparatus of claim 72, wherein the grooves include:  
a flow channel having a first radius of curvature;  
a first shoulder positioned on one side of the flow channel having a second radius of curvature; and  
a second shoulder positioned on the other side of the flow channel having a  
20 third radius of curvature.
94. The apparatus of claim 93, wherein the first, second and third radii of curvature are substantially equal.
- 25 95. The apparatus of claim 72, wherein the axial flow passages include:  
a flow channel having a first radius of curvature;  
a first shoulder positioned on one side of the flow channel having a second radius of curvature; and  
a second shoulder positioned on the other side of the flow channel having a  
30 third radius of curvature.
96. The apparatus of claim 95, wherein the first, second and third radii of curvature are substantially equal.

97. The apparatus of claim 95, wherein the second radius of curvature is greater than the third radius of curvature.

98. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:  
5 an expandable tubular member;  
an anchoring device adapted to couple the expandable tubular member to the preexisting structure; and  
an expansion cone movably coupled to the expandable tubular member and  
10 adapted to radially expand the expandable tubular member;  
wherein the expandable tubular member includes:  
an annular member, having:  
a wall thickness that varies less than about 8 %;  
a hoop yield strength that varies less than about 10 %;  
15 imperfections of less than about 8 % of the wall thickness;  
no failure for radial expansions of up to about 30 %; and  
no necking of the walls of the annular member for radial expansions of up to about 25%.

99. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:  
an expandable tubular member;  
an anchoring device adapted to couple the expandable tubular member to the preexisting structure; and  
25 an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member;  
wherein the expandable tubular member includes:  
a first tubular member;  
a second tubular member; and  
30 a threaded connection for coupling the first tubular member to the second tubular member, the threaded connection including:  
one or more sealing members for sealing the interface between the first and second tubular members.

100. The apparatus of claim 99, wherein the threaded connection comprises a pin and box threaded connection.

101. The apparatus of claim 99, wherein the sealing members are positioned  
5 adjacent to an end portion of the threaded connection.

102. The apparatus of claim 99, wherein one of the sealing members is positioned adjacent to an end portion of the threaded connection; and wherein another one of the sealing members is not positioned adjacent to an end portion of the threaded  
10 connection.

103. The apparatus of claim 99, wherein a plurality of the sealing members are positioned adjacent to an end portion of the threaded connection.

15 104. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:  
an expandable tubular member;  
an anchoring device adapted to couple the expandable tubular member to the preexisting structure; and  
20 an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member;  
wherein the expandable tubular member includes:  
a layer of a lubricant coupled to the interior surface of the tubular member.

25 105. The apparatus of claim 104, wherein the lubricant comprises a metallic soap.

106. The apparatus of claim 104, wherein the lubricant is selected from the group consisting of C-Lube-10, C-PHOS-58-M, and C-PHOS-58-R.

30 107. The apparatus of claim 104, wherein the lubricant provides a sliding friction coefficient of less than about 0.20.

108. The apparatus of claim 104, wherein the lubricant is chemically bonded to the interior surface of the expandable tubular member.  
35

109. The apparatus of claim 104, wherein the lubricant is mechanically bonded to the interior surface of the expandable tubular member.
110. The apparatus of claim 104, wherein the lubricant is adhesively bonded to the interior surface of the expandable tubular member.
111. The apparatus of claim 110, wherein the lubricant includes epoxy, molybdenum disulfide, graphite, aluminum, copper, aluminosilicate and polyethylenepolyamine.
112. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:
- an expandable tubular member;
  - an anchoring device adapted to couple the expandable tubular member to the preexisting structure; and
  - an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member;
- wherein the expandable tubular member includes:
- a pair of tubular members having threaded portions coupled to one another;
  - and
  - a quantity of a sealant within the threaded portions of the tubular members.
113. The apparatus of claim 112, wherein the sealant is selected from the group consisting of epoxies, thermosetting sealing compounds, curable sealing compounds, and sealing compounds having polymerizable materials.
114. The apparatus of claim 112, wherein the sealant includes an initial cure cycle and a final cure cycle.
115. The apparatus of claim 112, wherein the sealant can be stretched up to about 30 to 40 percent without failure.
116. The apparatus of claim 112, wherein the sealant is resistant to conventional wellbore fluidic materials.

117. The apparatus of claim 112, wherein the material properties of the sealant are substantially stable for temperatures ranging from about 0 to 450 °F.

118. The apparatus of claim 112, wherein the threaded portions of the tubular members include a primer for improving the adhesion of the sealant to the threaded portions.

119. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:

- an expandable tubular member;
- an anchoring device adapted to couple the expandable tubular member to the preexisting structure; and
- an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member;

wherein the expandable tubular member includes: a pair of rings for engaging the preexisting structure; and

a sealing element positioned between the rings for sealing the interface between the tubular member and the preexisting structure.

120. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:

- an expandable tubular member;
- an anchoring device adapted to couple the expandable tubular member to the preexisting structure; and
- an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member;

wherein the expandable tubular member includes one or more slots.

121. The apparatus of claim 120, wherein the slots are provided at a preexpanded portion of the expandable tubular member.

122. The apparatus of claim 120, wherein the slots are provided at a non-preexpanded portion of the tubular member.

123. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:
- an expandable tubular member;
  - an anchoring device adapted to couple the expandable tubular member to
  - 5 the preexisting structure; and
  - an expansion cone movably coupled to the expandable tubular member and adapted to radially expand the expandable tubular member;
  - wherein the expandable tubular member includes:
  - a first preexpanded portion;
  - 10 an intermediate portion coupled to the first preexpanded portion including a sealing element; and
  - a second preexpanded portion coupled to the intermediate portion.
124. An apparatus for coupling an expandable tubular member to a preexisting
- 15 structure, comprising:
- an expandable tubular member;
  - an anchoring device adapted to couple the expandable tubular member to the preexisting structure;
  - an expansion cone movably coupled to the expandable tubular member and
  - 20 adapted to radially expand the expandable tubular member; and
  - a valveable fluid passage coupled to the anchoring device.
125. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:
- 25 a first support member;
  - a second support member coupled to the first support member;
  - an expansion cone coupled to the first support member;
  - an expandable tubular member coupled to the expansion cone; and
  - an anchoring device coupled to the second support member adapted to
  - 30 couple the expandable tubular member to the preexisting structure;
  - wherein the anchoring device is positioned above the expansion cone.
126. The apparatus of claim 125, wherein the outside diameter of the expansion cone is greater than the inside diameter of the expandable tubular member.

35

127. The apparatus of claim 125, wherein the outside diameter of the expansion cone is approximately equal to the outside diameter of the expandable tubular member.

5 128. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:

- a first support member;
- a second support member coupled to the first support member;
- an expansion cone coupled to the first support member;
- 10 an expandable tubular member coupled to the expansion cone; and
- an explosive anchoring device coupled to the second support member adapted to couple the expandable tubular member to the preexisting structure.

129. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:

- 15 a support member;
- an expandable expansion cone coupled to the support member; and
- an expandable tubular member coupled to the expansion cone.

20 130. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:

- a support member;
- an expandable expansion cone coupled to the support member; and
- an expandable tubular member coupled to the expandable expansion cone.

25 131. The apparatus of claim 130, wherein the expandable tubular member includes one or more anchoring devices.

132. The apparatus of claim 130, wherein the expandable tubular member  
30 includes a slotted end portion.

133. An apparatus for coupling an expandable tubular to a preexisting structure, comprising:

- a support member;
- 35 an expansion cone coupled to the support member;

an expandable tubular member coupled to the expansion cone including one or more shape memory metal inserts; and

a heater coupled to the support member in opposing relation to the shape memory metal inserts.

5

134. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:

a support member;

an expansion cone coupled to the support member;

10

an expandable tubular member coupled to the expandable expansion cone;

and

a resilient anchor coupled to the expandable tubular member.

15

135. The apparatus of claim 134, wherein the resilient anchor includes:  
a resilient scroll.

136. The apparatus of claim 134, wherein the resilient anchor includes:  
one or more resilient arms.

20

137. The apparatus of claim 134, wherein the resilient anchor includes:  
one or more resilient radially oriented elements.

138. The apparatus of claim 134, wherein the resilient anchor is adapted to mate with the expansion cone.

25

139. An expandable tubular member, comprising:

an expandable tubular body;

one or more resilient panels coupled to the expandable tubular body; and

a release member releasably coupled to the resilient panels adapted to

30

controllably release the resilient panels.

140. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:

a support member;

35

an expansion cone coupled to the support member;

an expandable tubular member coupled to the expandable expansion cone;  
and

an anchor coupled to the expandable tubular member, including:  
one or more spikes pivotally coupled to the expandable tubular member for  
5 engaging the preexisting structure.

141. The apparatus of claim 140, further including one or more corresponding  
actuators for pivoting the spikes.

10 142. An apparatus for coupling an expandable tubular member to a preexisting  
structure, comprising:  
a support member;  
an expansion cone coupled to the support member;  
an expandable tubular member coupled to the expandable expansion cone;  
15 and  
an anchor coupled to the expandable tubular member, including:  
one or more petal baskets pivotally coupled to the expandable tubular  
member.

20 143. The apparatus of claim 142, further including one or more corresponding  
actuators for pivoting the petal baskets.

144. An apparatus for coupling an expandable tubular member to a preexisting  
structure, comprising:  
25 a support member;  
an expansion cone coupled to the support member;  
an expandable tubular member coupled to the expansion cone, including:  
a slotted portion provided at one end of the expandable tubular member.

30 145. An apparatus for coupling an expandable tubular member to a preexisting  
structure, comprising:  
a support member;  
an expansion cone;  
an expandable tubular member coupled to the expansion cone;

a coupling device coupled to the support member and an end portion of the expandable tubular member; and  
a mass coupled to the end portion of the expandable tubular member;  
wherein the weight of the mass is greater than about 50 to 100 % of the yield  
5 strength of the expandable tubular member.

146. An apparatus for coupling an expandable tubular member to a preexisting structure, comprising:  
a support member including a fluid passage;  
10 an expansion cone coupled to the support member;  
an expandable tubular member coupled to the expansion cone;  
a slip joint coupled to the expansion cone;  
an end plate coupled to the slip joint;  
a fluid chamber coupled to the fluid passage, the fluid chamber defined by  
15 the interior portion of the expandable tubular member between the expansion cone and the end plate.

147. A method of coupling a tubular member to a preexisting structure, comprising:  
20 positioning the tubular member and an expansion cone within the preexisting structure;  
axially displacing the expansion cone;  
removing the expansion cone; and  
applying direct radial pressure to the tubular member.

25 148. The method of claim 147, wherein axially displacing the expansion cone includes:  
pressurizing at least a portion of the interior of the tubular member.

30 149. The method of claim 147, wherein axially displacing the expansion cone includes:  
injecting a fluidic material into the tubular member.

150. The method of claim 147, wherein axially displacing the expansion cone  
35 includes:

applying a tensile force to the expansion cone.

151. The method of claim 147, wherein axially displacing the expansion cone includes:

5        displacing the expansion cone into the tubular member.

152. The method of claim 147, wherein axially displacing the expansion cone includes:

10        displacing the expansion cone out of the tubular member.

153. The method of claim 147, wherein axially displacing the expansion cone radially expands the tubular member by about 10% to 20%.

154. The method of claim 147, wherein applying direct radial pressure to the first  
15        tubular member radially expands the tubular member by up to about 5%.

155. The method of claim 147, wherein applying direct radial pressure to the tubular member includes applying a radial force at discrete locations.

20        156. The method of claim 147, wherein the preexisting structure includes a wellbore casing.

25        157. The method of claim 147, wherein the preexisting structure includes a pipeline.

158. The method of claim 147, wherein the preexisting structure includes a structural support.

159. An apparatus, comprising:  
30        a tubular member coupled to a preexisting structure;  
          wherein the tubular member is coupled to the preexisting structure by the process of:  
          positioning the tubular member and an expansion cone within the preexisting structure;  
35        axially displacing the expansion cone;

removing the expansion cone; and  
applying direct radial pressure to the tubular member.

5 160. The apparatus of claim 159, wherein axially displacing the expansion cone includes:  
pressurizing at least a portion of the interior of the tubular member.

10 161. The apparatus of claim 159, wherein axially displacing the expansion cone includes:  
injecting a fluidic material into the tubular member.

15 162. The apparatus of claim 159, wherein axially displacing the expansion cone includes:  
applying a tensile force to the expansion cone.

163. The apparatus of claim 159, wherein axially displacing the expansion cone includes:  
displacing the expansion cone into the tubular member.

20 164. The apparatus of claim 159, wherein axially displacing the expansion cone includes:  
displacing the expansion cone out of the tubular member.

25 165. The apparatus of claim 159, wherein axially displacing the expansion cone radially expands the tubular member by about 10% to 20%.

166. The apparatus of claim 159, wherein applying direct radial pressure to the tubular member radially expands the tubular member by up to about 5%.

30 167. The apparatus of claim 159, wherein applying direct radial pressure to the tubular member includes applying a radial force at discrete locations.

35 168. The apparatus of claim 159, wherein the preexisting structure includes a wellbore casing.

169. The apparatus of claim 159, wherein the preexisting structure includes a pipeline.

170. The apparatus of claim 159, wherein the preexisting structure includes a structural support.

171. A system for coupling an expandable tubular member to a preexisting structure, comprising:

- means for positioning the tubular member and an expansion cone within the preexisting structure;
- means for anchoring the tubular member to the preexisting structure;
- means for axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member; and
- means for lubricating the interface between the expansion cone and the tubular member.

172. The system of claim 171, wherein the means for lubricating the interface between the expansion cone and the tubular member includes:

- means for injecting a lubricating fluid into the trailing edge of the interface between the expansion cone and the tubular member.

173. The system of claim 172, wherein the lubricating fluid has a viscosity ranging from about 1 to 10,000 centipoise.

174. The system of claim 172, wherein the injecting includes:

- injecting lubricating fluid into a tapered end of the expansion cone.

175. The system of claim 172, wherein the means for injecting includes:

- means for injecting lubricating fluid into the area around the axial midpoint of a first tapered end of the expansion cone.

176. The system of claim 172, wherein the means for injecting includes:

- means for injecting lubricating fluid into a second end of the expansion cone.

177. The system of claim 172, wherein the means for injecting includes:

means for injecting lubricating fluid into a tapered first end and a second end of the expansion cone.

5 178. The system of claim 172, wherein the means for injecting includes:  
means for injecting lubricating fluid into an interior of the expansion cone.

179. The system of claim 172, wherein the means for injecting includes:  
means for injecting lubricating fluid through an outer surface of the expansion  
cone.

10 180. The system of claim 172, wherein the means for injecting includes:  
means for injecting the lubricating fluid into a plurality of discrete locations  
along the trailing edge portion.

15 181. The system of claim 172, wherein the lubricating fluid comprises:  
drilling mud.

182. The system of claim 172, wherein the lubricating fluid further includes:  
TorqTrim III;  
20 EP Mudlib; and  
DrillN-Slid.

183. The system of claim 172, wherein the lubricating fluid comprises:  
TorqTrim III;  
25 EP Mudlib; and  
DrillN-Slid.

184. The system of claim 711, wherein the means for lubricating the interface  
between the expansion cone and the tubular member includes:  
30 means for coating the interior surface of the tubular member with a lubricant.

185. The system of claim 171, wherein the means for lubricating the interface  
between the expansion cone and the tubular member includes:  
means for coating the interior surface of the tubular member with a first part  
35 of a lubricant; and

means for applying a second part of the lubricant to the interior surface of the tubular member.

186. The system of claim 184, wherein the lubricant comprises a metallic soap.

187. The system of claim 184, wherein the lubricant is selected from the group consisting of C-Lube-10, C-PHOS-58-M, and C-PHOS-58-R.

188. The system of claim 184, wherein the lubricant provides a sliding friction coefficient of less than about 0.20.

189. The system of claim 184, wherein the lubricant is chemically bonded to the interior surfaces of the tubular members.

190. The system of claim 184, wherein the lubricant is mechanically bonded to the interior surfaces of the tubular members.

191. The system of claim 184, wherein the lubricant is adhesively bonded to the interior surface of the tubular members.

192. The system of claim 184, wherein the lubricant includes epoxy, molybdenum disulfide, graphite, aluminum, copper, aluminosilicate and polyethylenepolyamine.

193. A system for coupling a tubular member to a preexisting structure, comprising:

positioning the tubular member and an expansion cone within the preexisting structure;

anchoring the tubular member to the preexisting structure; and

axially displacing the expansion cone relative to the tubular member by

pulling the expansion cone through the tubular member;

wherein the tubular member includes:

an annular member, including:

a wall thickness that varies less than about 8 %;

a hoop yield strength that varies less than about 10 %;

imperfections of less than about 8 % of the wall thickness;

- no failure for radial expansions of up to about 30 %; and
- no necking of the walls of the annular member for radial expansions of up to about 25%.

5    194.    A system for coupling a tubular member to a preexisting structure, comprising:

- injecting a lubricating fluid into the preexisting structure;
- positioning the tubular member and an expansion cone within the preexisting structure;
- 10        anchoring the tubular member to the preexisting structure; and
- axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member.

15        195.    The system of claim 194, wherein the lubricating fluid comprises:  
BARO-LUB GOLD-SEAL™ brand drilling mud lubricant.

196.    A system for coupling an expandable tubular member to a preexisting structure, comprising:

- means for positioning the expandable tubular member and an expansion
- 20        cone within the preexisting structure;
- means for anchoring the expandable tubular member to the preexisting structure; and
- means for axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular
- 25        member;

- wherein the expandable tubular member includes:
- a first tubular member;
- a second tubular member; and
- a threaded connection for coupling the first tubular member to the second
- 30        tubular member, the threaded connection including:
- one or more sealing members for sealing the interface between the first and second tubular members.

35        197.    The system of claim 196, wherein the threaded connection comprises a pin and box threaded connection.

198. The system of claim 196, wherein the sealing members are positioned adjacent to an end portion of the threaded connection.

5 199. The system of claim 196, wherein one of the sealing members is positioned adjacent to an end portion of the threaded connection; and wherein another one of the sealing members is not positioned adjacent to an end portion of the threaded connection.

10 200. The system of claim 196, wherein a plurality of the sealing members are positioned adjacent to an end portion of the threaded connection.

201. A system for coupling an expandable tubular member to a preexisting structure, comprising:

15 means for positioning the expandable tubular member and an expansion cone within the preexisting structure;

means for anchoring the expandable tubular member to the preexisting structure; and

20 means for axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member;

wherein the expandable tubular member includes a plurality of tubular members having threaded portions that are coupled to one another by the process of:

25 coating the threaded portions of the tubular members with a sealant; coupling the threaded portions of the tubular members; and curing the sealant.

30 202. The system of claim 201, wherein the sealant is selected from the group consisting of epoxies, thermosetting sealing compounds, curable sealing compounds, and sealing compounds having polymerizable materials.

203. The system of claim 201, further including:  
35 means for initially curing the sealant prior to radially expanding the tubular members; and

means for finally curing the sealant after radially expanding the tubular members.

204. The system of claim 201, wherein the sealant can be stretched up to about  
5 30 to 40 percent after curing without failure.

205. The system of claim 201, wherein the sealant is resistant to conventional wellbore fluidic materials.

10 206. The system of claim 201, wherein the material properties of the sealant are substantially stable for temperatures ranging from about 0 to 450 °F.

207. The system of claim 201, further including:  
means for applying a primer to the threaded portions of the tubular members  
15 prior to coating the threaded portions of the tubular members with the sealant.

208. The system of claim 207, wherein the primer includes a curing catalyst.

209. The system of claim 207, wherein the primer is applied to the threaded  
20 portion of one of the tubular members and the sealant is applied to the threaded portion of the other one of the tubular members.

210. The system of claim 207, wherein the primer includes a curing catalyst.

25 211. A system for coupling a tubular member to a preexisting structure, comprising:  
positioning the tubular member and an expansion cone within the preexisting structure;  
anchoring the tubular member to the preexisting structure; and  
30 axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the expandable tubular member;  
wherein the tubular member includes:  
a pair of rings for engaging the preexisting structure; and  
a sealing element positioned between the rings for sealing the interface  
35 between the tubular member and the preexisting structure.

212. A system for coupling a tubular member to a preexisting structure, comprising:

- 5 positioning the expandable tubular member and an expansion cone within the preexisting structure;
- anchoring the expandable tubular member to the preexisting structure; and
- axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member;
- 10 wherein the tubular member includes one or more slots.

213. The system of claim 212, wherein the slots are provided at a preexpanded portion of the tubular member.

214. The system of claim 212, wherein the slots are provided at a non-preexpanded portion of the tubular member.

215. A system for coupling a tubular member to a preexisting structure, comprising:

- 20 positioning the expandable tubular member and an expansion cone within the preexisting structure;
- anchoring the expandable tubular member to the preexisting structure; and
- axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member;
- wherein the tubular member includes:
- 25 a first preexpanded portion;
- an intermediate portion coupled to the first preexpanded portion including a sealing element; and
- a second preexpanded portion coupled to the intermediate portion.

30 216. A system for coupling a tubular member to a preexisting structure, comprising:

- positioning the expandable tubular member and an expansion cone within the preexisting structure;
- anchoring the expandable tubular member to the preexisting structure; and

axially displacing the expansion cone relative to the expandable tubular member by pulling the expansion cone through the expandable tubular member by applying an axial force to the expansion cone;

wherein the axial force includes:

- 5       a substantially constant axial force; and  
      an increased axial force.

217. The system of claim 216, wherein the increased axial force is provided on a periodic basis.

10

218. The system of claim 216, wherein the increased axial force is provided on a random basis.

15

219. The system of claim 216, wherein the ratio of the increased axial force to the substantially constant axial force ranges from about 5 to 40 %.

220. A system for coupling a tubular member to a preexisting structure, comprising:

20       means for positioning the tubular member and an expansion cone within the preexisting structure;

      means for anchoring the tubular member to the preexisting structure; and

      means for axially displacing the expansion cone relative to the expandable tubular member by pushing and pulling the expansion cone through the expandable tubular member.

25

221. The system of claim 220, wherein the means for pushing the expansion cone includes:

      means for injecting a pressurized fluidic material into contact with the expansion cone.

30

222. A system for coupling a tubular member to a preexisting structure, comprising:

      means for positioning the tubular member and an expansion cone within the preexisting structure;

35

      means for anchoring the tubular member to the preexisting structure;

means for axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the expandable tubular member; and

5 means for injecting a curable fluidic sealing material between the tubular member and the preexisting structure prior to axially displacing the expansion cone.

223. A system for coupling a tubular member to a preexisting structure, comprising:

10 means for positioning the tubular member and an expansion cone within the preexisting structure;

means for anchoring the tubular member to the preexisting structure by increasing the size of the expansion cone; and

15 means for axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member.

224. A system for coupling a tubular member to a preexisting structure, comprising:

20 means for positioning the tubular member and an expansion cone within the preexisting structure;

means for anchoring the tubular member to the preexisting structure by heating a portion of the tubular member; and

means for axially displacing the expansion cone relative to the tubular member by pulling the expansion cone through the tubular member.

25 225. A system for coupling an expandable tubular member to a preexisting structure, comprising:

means for positioning the expandable tubular member, an expansion cone, and an anchoring device within the preexisting structure;

30 means for positioning the anchoring device above the expansion cone; means for anchoring the expandable tubular member to the preexisting structure using the anchoring device; and

means for axially displacing the expansion cone.

35 226. A system for coupling an expandable tubular member to a preexisting structure, comprising:

means for positioning the tubular member and an expansion cone within the preexisting structure;

means for explosively anchoring the tubular member to the preexisting structure; and

5 means for axially displacing the expansion cone relative to the tubular member.

227. A system for coupling an expandable tubular to a preexisting structure, comprising:

10 means for fixing the position of an expansion cone within the preexisting structure;

means for driving the expandable tubular member onto the expansion cone in a first direction; and

15 means for axially displacing the expansion cone in a second direction relative to the expandable tubular member;

wherein the first and second directions are different.

228. A system for coupling an expandable tubular member to a preexisting structure, comprising:

20 means for placing the expandable tubular, an expansion cone, and a resilient anchor within the preexisting structure;

means for releasing the resilient anchor; and

25 means for axially displacing the expansion cone within the expandable tubular member.

229. A system for coupling an expandable tubular member to a preexisting structure, comprising:

means for placing the expandable tubular member, an expansion cone, and an anchor into the preexisting structure;

30 means for anchoring the expandable tubular member to the preexisting structure that includes means for pivoting one or more engagement elements; and means for axially displacing the expansion cone.

230. The system of claim 229, wherein the means for pivoting the engagement elements includes:

means for actuating the engagement elements.

231. The system of claim 229, wherein the means for pivoting the engagement elements includes:

5 means for placing a quantity of a fluidic material onto the engagement elements.

232. The system of claim 229, wherein the means for pivoting the engagement elements includes:

10 means for displacing the expandable tubular member.

233. A system for coupling an expandable tubular member to a preexisting structure, comprising:

15 means for placing the expandable tubular member and an expansion cone into the preexisting structure;

means for placing a quantity of a fluidic material onto the expandable tubular member to anchor the expandable tubular member to the preexisting structure; and  
means for axially displacing the expansion cone.

20 234. The system of claim 233, wherein the fluidic material comprises a barite plug.

235. The system of claim 233, wherein the fluidic material comprises a flex plug.

25 236. A system for coupling an expandable tubular member to a preexisting structure, comprising:

means for positioning the expandable tubular member and an expansion cone into the preexisting structure;

30 means for anchoring the expandable tubular member to the preexisting structure by injecting a quantity of a hardenable fluidic material into the preexisting structure;

means for at least partially curing the hardenable fluidic sealing material; and  
means for axially displacing the expansion cone.

35 237. A system for coupling an expandable tubular member to a preexisting structure, comprising:

means for placing the expandable tubular member and an expansion cone within the preexisting structure; and

means for applying an axial force to the expandable tubular member in a downward direction.

5

238. A system for coupling an expandable tubular member to a preexisting structure, comprising:

means for placing the expandable tubular member and an expansion cone within the preexisting structure;

10 means for injecting a quantity of a first fluidic material having a first density into the region of the preexisting structure outside of the expandable tubular member; and

means for injecting a quantity of a second fluidic material having a second density into a portion of the expandable tubular member below the expansion cone;

15 wherein the second density is greater than the first density.

239. A system for coupling an expandable tubular member to a preexisting structure, comprising:

20 means for placing the expandable tubular member and an expansion cone into the preexisting structure;

means for anchoring the expandable tubular member to the preexisting structure;

means for applying an axial force to the expansion cone; and

25 means for pressurizing an interior portion of the expandable tubular member below the expansion cone.

240. A system for coupling an expandable tubular member to a preexisting structure, comprising:

30 means for placing the expandable tubular member and an expansion cone into the preexisting structure; and

means for applying an axial force to the expandable tubular member.

241. A system for coupling a tubular member to a preexisting structure, comprising:

means for positioning the tubular member and an expansion cone within the preexisting structure;

means for axially displacing the expansion cone;

means for removing the expansion cone; and

5 means for applying direct radial pressure to the tubular member.

242. The system of claim 241, wherein the means for axially displacing the expansion cone includes:

10 means for pressurizing at least a portion of the interior of the tubular member.

243. The system of claim 241, wherein the means for axially displacing the expansion cone includes:

15 means for injecting a fluidic material into the tubular member.

244. The system of claim 241, wherein the means for axially displacing the expansion cone includes:

means for applying a tensile force to the expansion cone.

20 245. The system of claim 241, wherein the means for axially displacing the expansion cone includes:

means for displacing the expansion cone into the tubular member.

25 246. The system of claim 241, wherein the means for axially displacing the expansion cone includes:

means for displacing the expansion cone out of the tubular member.

247. The system of claim 241, wherein the means for axially displacing the expansion cone radially expands the tubular member by about 10% to 20%.

30 248. The system of claim 241, wherein the means for applying direct radial pressure to the first tubular member radially expands the tubular member by up to about 5%.

249. The system of claim 241, wherein the means for applying direct radial pressure to the tubular member includes means for applying a radial force at discrete locations.

5 250. The system of claim 241, wherein the preexisting structure includes a wellbore casing.

251. The system of claim 241, wherein the preexisting structure includes a pipeline.

10

252. The system of claim 241, wherein the preexisting structure includes a structural support.



Application No: GB0404833.6

Examiner: Dave Pepper

Claims searched: 1 to 63

Date of search: 20 April 2004

## Patents Act 1977: Search Report under Section 17

### Documents considered to be relevant:

| Category | Relevant to claims | Identity of document and passage or figure of particular reference |
|----------|--------------------|--|
| A        | -                  | GB 2356651 A<br>Shell Internationale Research                      |
| A        | -                  | WO 01/04535 A<br>Enventure Global Technology                       |

### Categories:

|   |   |   |  |
|---|---|---|--|
| X | Document indicating lack of novelty or inventive step   | A | Document indicating technological background and/or state of the art.  |
| Y | Document indicating lack of inventive step if combined with one or more other documents of same category. | P | Document published on or after the declared priority date but before the filing date of this invention.          |
| & | Member of the same patent family  | E | Patent document published on or after, but with priority date earlier than, the filing date of this application. |

### Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>W</sup>:

E1F

Worldwide search of patent documents classified in the following areas of the IPC<sup>07</sup>

E21B

The following online and other databases have been used in the preparation of this search report

Online: WPI, EPODOC

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☒ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☒ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☒ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER: \_\_\_\_\_**

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**